

TOWARDS AN OMEGA TAXONOMY IN THE
DESMIDIACEAE (CHLOROPHYTA)

by

SUSAN I. ^{rene}BLACKBURN

(^{now} Susan Irene Edgar)

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BLACKBURN
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Susan J. Blackburn

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CONTENTS

	<u>page</u>
ABSTRACT	
1. INTRODUCTION	1
2. MATERIALS AND METHODS	26
2.1 Collection of Samples	26
2.2 Culturing Techniques	26
2.3 Cell Morphology	29
2.3.1 Wild Type Morphology	29
2.3.2 Cultured Cell Morphology	31
2.4 Crossing Techniques	31
2.4.1 Induction of Sexual Reproduction	31
2.4.2 Zygospor e Maturation and Germination	32
2.4.3 Culturing and Crossing of Products of Zygospor e Germination	33
2.5 Nuclear Cytology	33
2.5.1 Meiosis	33
2.5.2 Mitosis	35
2.6 Photography and Drawing	36
2.7 Terminology Used for Identification of Strains	37
3. <i>MICRASTERIAS THOMASIANA-DENTICULATA</i> COMPLEX - A STUDY OF MORPHOLOGY, SEXUAL REPRODUCTION, GENETIC COMPATI- BILITY AND MEIOSIS	40
3.1 Morphology	40
3.2 Sexual Reproduction	51
3.3 Sexual Compatibility	55
3.4 Genetic Compatibility - GP ₁ Viability and Backcrosses	66
3.4.1 GP ₁ Viability	66
3.4.2 Backcrosses	68
3.5 Observations on Meiosis	75
3.6 Discussion	84

	<u>page</u>
4. <i>MICRASTERIAS MAHABULESHWARENSIS</i> HOBSON - A STUDY OF MORPHOLOGY, SEXUAL REPRODUCTION, GENETIC COMPATIBILITY AND MEIOSIS WITH SOME OBSERVATIONS ON THE CLOSELY RELATED SPECIES, <i>M. AMERICANA</i> (EHRENB.) RALFS AND <i>M. RADIATA</i> HASS.	96
4.1 Morphology	96
4.2 Sexual Reproduction	108
4.3 Sexual Compatibility	112
4.4 Genetic Compatibility - GP _i Viability, Fertility and Backcrosses	119
4.5 Observations on Meiosis	125
4.6 Discussion	131
5. SEXUAL REPRODUCTION AND COMPATIBILITY, AND NUCLEAR CYTOLOGY IN <i>PLEUROTAENIUM</i>	141
5.1 Morphology	141
5.2 Sexual Reproduction and Compatibility	147
5.3 The Nucleus and Mitosis	152
5.4 Discussion	166
6. SEXUAL COMPATIBILITY IN NORTHERN TERRITORY DESMIDS	174
6.1 Introduction and Results	174
6.2 Discussion	180
7. DISCUSSION AND CONCLUSIONS	184
SUMMARY	219
REFERENCES	221
FIGURES	
APPENDIX 1	
APPENDIX 2	

ABSTRACT

The systematics of the Desmidiaceae is based upon comparative iconography of cell morphology (alpha taxonomy) with current nomenclature dating from 1848 with the publication of "The British Desmidiaceae" by J. Ralfs. The widespread distribution of many desmids, the diversity of form and the subjective element involved in type specimens being recorded as iconotypes has produced a cumbersome and often ambiguous alpha taxonomy.

In recent years there has been a trend towards a more natural and biologically meaningful taxonomy (omega taxonomy) in higher plants and animals as well as some algae. This, plus the problems associated with desmid alpha taxonomy, instigated this investigation of vegetative and sexual morphology, genetic compatibility, and nuclear cytology in certain desmids. Most of these studies involved the use of unialgal cultures under controlled environmental conditions. In particular two *Micrasterias* species, *M. thomasicana* and *M. mahabuleshwariensis* and related taxa were chosen for their cosmopolitan distributions. This permitted comparisons of the genetic compatibility underlying morphological uniformity, or continua, on a global basis as well as in the more localized situation.

A study of wild and cultured cell morphology of these *Micrasterias* species groups was followed by an investigation of the processes and morphological aspects of sexual reproduction. Sexual compatibility at both the intra-locality (within-population) level and the inter-locality (between-populations) level was tested by a series of crosses, zygospore production being taken as the criterion of sexual compatibility. Genetic compatibility to the extent of viability and fertility of the products of zygospore germination (GP₁) was also examined. In a limited number of cases potential gene flow between strains, which is the ultimate criterion of the "biological species", was investigated by backcrosses of zygospore products to parental strains. In addition, studies of

meiosis and chromosome complements in germination vesicles were undertaken to determine whether a cytogenetic basis existed for taxonomic delimitation.

Similar studies were made on a number of *Pleurotaenium* strains spanning several alpha taxa. However, mitosis in vegetative cells and not meiosis was investigated for selected strains.

Finally a cursory examination of some desmids from tropical Northern Australia was made to investigate diversity and sexual reproduction in the special ecological conditions of this region.

These investigations revealed a genetic complexity within alpha taxonomic species, far exceeding morphological plasticity. Complex patterns of sexual and genetic compatibility within a single locality contrasted with compatibility between strains from the United Kingdom and Australia, and North America and Australia. At the cytological level genetic compatibility was often associated with widely differing chromosome complements, even within a single strain.

The results are discussed with respect to possible dispersal and evolutionary patterns in desmids. It is concluded that at this stage alpha taxonomy must be retained for the desmids but that a more realistic approach to desmid systematics ought to be possible when aided by a knowledge of the genetic variability and compatibility.